

DESCRIPTION

DATA PROCESSING APPARATUS AND DATA PROCESSING METHOD,
AND COMPUTER PROGRAM

5 TECHNICAL FIELD

The present invention relates to a data processing apparatus and data processing method and, more particularly, to a management method of page data in a multi-function peripheral apparatus (to be referred to as an MFP apparatus hereinafter) that handles page data in a plurality of data formats.

BACKGROUND ART

In a conventional MFP apparatus which handles image data in a plurality of data formats, an image data input unit such as scanning, FAX reception, network reception, and the like encodes/decodes page data input from an input interface to that in a data format (encoding format) unique to the apparatus, and stores the page data in the apparatus as storage data.

Also, an image data output unit such as recording, FAX transmission, network transmission, and the like converts the storage data stored in the data format unique to the apparatus into a required data format, and outputs the converted data to an output interface. As described above, page data in different data formats (encoding formats), which are generated by

the input and output units and are used, are independently managed.

Fig. 1 shows the structure of page management records in such conventional MFP apparatus. That is, an image (Raw data) scanned by an image reader (scanner) is encoded to JBIG as an encoding format unique to the MFP apparatus, and is stored in a memory as JBIG data. Upon using this JBIG data, it is converted into a data format (encoding format) required for a function to be used (e.g., a FAX transmission function), and the converted data is used. Therefore, the conventional MFP apparatus manages data to be handled in a single encoding format like, e.g., JBIG. As shown in Fig. 1, page management records 10a, 10b,... respectively manage only JBIG page data 20a, 20b,... Note that JBIG data is stored in a memory managed by the JBIG page data.

However, the conventional MFP apparatus manages and stores data in a common data format (JBIG format). When raw data is input and is immediately output (copied), raw data → JBIG conversion is purposely made, and a storage process is then executed. After that, since JBIG data → raw data re-conversion is made, a time loss for the storage process is produced, resulting in a low output speed.

In the conventional MFP apparatus, for example, when the first page is JBIG data, the second page is

TXT data, and the third page is TIFF data in a single document, each page management record can only have page data in a specific data format unique to the apparatus, and cannot manage each page in an original encoding format. Hence, the image data output unit cannot use page data until the image data input unit completes encoding/decoding to storage data and generates page data, thus requiring a long processing time from input to output of image data.

If the conventional MFP apparatus supports and manages data in various different data formats (encoding formats), it must generate page data in different data formats (encoding formats) and must manage them independently although they form a single document, as shown in Figs. 2A to 2C. That is, when the image data output unit (recording, FAX transmission, network transmission) that requires data format conversion must have page management records for page data conversion and page data themselves, and management is made in this way, the memory use size increases, resulting in high apparatus cost.

The present invention has been made to solve the aforementioned problems, and has as its object to provide a data process apparatus which can implement an encoding process which efficiently supports respective image processing functions while minimizing the memory use size in the apparatus.

DISCLOSURE OF INVENTION

According to one aspect of the present invention, preferably, a data processing apparatus for processing data for respective pages, comprises a data reception unit for receiving at least data of a first format for respective pages, a data conversion unit for converting the data of the first format into data of a second format, a page data management unit for managing the data of the first and second formats in first and second page data in association with each other and a control unit for monitoring a storage state of the data of the first format in a memory, and permitting a predetermined process for the data of the first format in accordance with the storage state.

According to another aspect of the present invention, preferably, a data processing method for processing data for respective pages, comprises a data reception step of receiving at least data of a first format for respective pages, a first page data generation step of generating first page data used to manage the data of the first format, a control step of monitoring a storage state of the data of the first format in the memory, and permitting a predetermined process for the data of the first format in accordance with the storage state, a data conversion step of converting the data of the first format into data of a

second format, a second page data generation step of generating second page data used to manage the data of the second format and a page data management step of managing the data of the first and second formats in 5 first and second page data in association with each other.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying 10 drawings, in which like reference characters designate the same or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF DRAWINGS

15 The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

20 Fig. 1 shows the structure of page management records in the conventional MFP apparatus;

Figs. 2A to 2C are schematic views showing the page data management method when the conventional MFP apparatus supports and manages data in various 25 different data formats (encoding formats);

Fig. 3 is a block diagram showing the arrangement of an image processing apparatus 100 according to the present invention;

Fig. 4 shows the structure of page management records according to the present invention;

Fig. 5 is a schematic view showing the page data management method using the page management records according to the present invention;

Fig. 6 is a view showing a detailed example of the page data management method using the page management records according to the present invention;

Fig. 7 is a schematic diagram showing the relationship among the page management record, page data, and respective processors according to the present invention;

Fig. 8 is a flowchart for explaining the page data generation and management operations using the page management records according to the present invention;

Fig. 9 is a schematic view for explaining an example of a series of operations from data scanning until generation of page management records;

Fig. 10 is a flowchart for explaining an example of the page data control operation using the page management records according to the present invention;

Fig. 11 is a view showing the concept of the page data control operation;

Fig. 12 is a view showing the concept of another page data control operation; and

Fig. 13 is a view showing the concept of still another page data control operation.

5

BEST MODE FOR CARRYING OUT THE INVENTION

An MFP (multi-function peripheral) apparatus will be exemplified hereinafter in association with a data processing apparatus according to the present invention.

10

<Hardware Arrangement>

Fig. 3 is a block diagram showing the arrangement of an image processing apparatus as an embodiment of the present invention.

15

Referring to Fig. 3, an image processing apparatus 100 has a CPU 101, ROM 102, RAM 103, scanner 104, printer 105, CODEC 106, operation/display unit 107, line I/F 108, network I/F 110, and USB I/F 112.

20

The CPU 101 serves as a system controller, and controls the overall image processing apparatus 100. The ROM 102 stores a control program of the CPU 101.

Note that the aforementioned control program is used to implement the embodiment to be described hereinafter.

25

The ROM 102 also stores a memory management program of a memory manager 610 (to be described later; Fig. 9).

The RAM 103 comprises an SRAM, DRAM, or the like, and stores program control variables and the like. The

RAM 103 also stores setting values registered by the user of the image processing apparatus 100, management data of the image processing apparatus 100, and the like, and various work buffers.

5 In this embodiment, a page management record 200 and page data 210 are stored in the RAM 103 every time they are generated, and are deleted from the RAM 103 when a release process is executed.

10 The scanner 104 comprises a CS image sensor, document feeder mechanism, and the like. The scanner 104 optically scans a document image, and converts it into electrical image data.

The printer 105 prints a received image or file data on a print sheet.

15 The CODEC 106 is a module for performing encoding and decoding such as JBIG, JPEG, and the like, i.e., a processor for executing compression and expansion processes of image data complying with a predetermined standard.

20 The operation/display unit 107 comprises a keyboard, touch panel, LCD, LED, and the like. The operation/display unit 107 is used by the apparatus user to make various operations, and displays messages to the apparatus user.

25 The line I/F 108 comprises a modem (modulator/demodulator), NCU (network control unit),

and the like, and performs FAX transmission/reception via a telephone line 109.

The network I/F 110 and USB I/F 112 perform interface control with a connected external PC via a 5 network 111 and USB 113. Job requests such as a print job, scan job, and the like can be received from the PC via these interfaces.

<Page Data Management Method>

Figs. 4 to 7 are schematic views showing the page 10 data management method according to the present invention. Note that page management records 200a, 200b, 200c,... are not already prepared in the RAM 103 but are generated if they are required, and are deleted when they become unnecessary. This operation will be 15 described later.

Fig. 4 is a schematic view showing the mutual relationship among the page management records 200a, 200b, 200c,..., and also the relationship between one page management record (e.g., 200a) and encoding modes 20 to be managed in that record.

Referring to Fig. 4, a page management record is management data used to manage page data corresponding to respective encoding modes, and stores various kinds of information associated with page data (the detailed 25 structure will be described later). When an image includes a plurality of pages, the page management record saves a pointer to a page management record of

the next page, and page management records are associated with each other using a tree structure.

In this embodiment, the page management record can have a plurality of page data of different encoding formats (data formats) such as Raw Mono, Raw Color, 5 JBIG, JPEG, TIFF, TEXT, and the like, as needed.

More specifically, each page management record saves pointers to respective page data, as shown in Fig. 5. For example, the page management record 200a 10 for the first page manages RAW page data 220 and JBIG page data 230 of those of supported encoding formats. Each page data stores RAW data and JBIG data at predetermined address positions of a memory block which is managed in association with that page data.

15 Likewise, the page management record 200b for the second page manages TXT page data 240 associated with text data, and the page management record 200c for the third page manages TIFF page data associated with TIFF data, and JPEG page data associated with JPEG data. 20 Note that these combinations are merely examples, and other combinations are available, as a matter of course.

Fig. 6 shows the structure of the page management record 200, and the relationship among the page management record 200, JBIG page data 210c, RAW page data 210a, and Memory_Block 310. A combination of

these data formats (encoding formats) is merely an example, and another combination is available.

As shown in Fig. 6, the page management record includes a Next pointer, Prev pointer, Page_No., Code, 5 Status, Link_Count, Free_Flag, and the like. Note that the Next pointer indicates a pointer (address on the RAM 103) of the page management record of the next page, and stores "Null" when no next page is available. The Prev pointer indicates a pointer of the page 10 management record of the previous page, and stores "Null" when no previous page is available (when the page of interest is the first page).

Page_No. is information indicating the page position of a document to be processed of the page of 15 interest. Code is information indicating the encoding formats of data to be managed. In the example of Fig. 6, RAW (raw) data and JBIG data are to be managed.

Status manages two types of information, i.e., the status of the overall page management record 200 20 and the status of each encoding format. The status includes RUN indicating generation in progress, and FIX indicating completion of generation. For example, when this Status indicates generation in progress of the JBIG page data 210c (RUN), other processors such as a 25 print processor, FAX processor, and the like cannot use that JBIG data, and must stand by until Status

indicates completion of generation of the JBIG data (FIX).

Link_Count indicates processors that refer to the page management record 200 of interest. That is, when
5 an arbitrary processor (which can be the print processor or FAX processor) refers to the page management record 200 of interest and is about to use predetermined data managed by that record, this Link_Count counts the number of processors that refer
10 to this record. When none of processors refer to this record, Link_Count is "0".

Free_Flag is set "ON" when reference to the page management record 200 of interest by the processor is complete, and that page management record can be
15 deleted. Therefore, when the Link_Count is "0" and Free_Flag is "ON", it is determined that reference by all the processors is complete, and that page management record 200 can be deleted.

For the purpose of easy understanding, an
20 operation example associated with Status, Link_Count, and Free_Flag will be described below using Fig. 7. When a document is scanned by a scanner processor 410, a page management record generation request is issued. In this state, Status indicates that the page
25 management record = "RUN". As data are scanned by the scanner processor 410, RAW page data are generated, and are stored in an associated memory. Furthermore, JBIG

page data are generated, and the RAW data are encoded by JBIG and are stored in the memory. Before these page data are generated and are stored, RAW page data = "RUN" or JBIG data = "RUN" in Status. After these data 5 are stored, RAW page data = "FIX" or JBIG data = "FIX" in Status.

In this case, when a printer processor 420 and FAX processor 430 refer to the page management record 200 of interest to use RAW data or JBIG data, 10 Link_Count indicates "2". When both the printer processor 420 and FAX processor 430 have ended reference, Link_Count becomes "0". On the other hand, when the printer processor 420 or FAX processor 430 has ended reference, it issues a delete request (release 15 request) to the page management record 200, and Free_Flag is set "ON" in this case. As described above, when Link_Count = "0" and Free_Flag = "ON", the role of the page management record 200 of interest is fulfilled, and that record is deleted.

20 Referring back to Fig. 6, the relationship between the page data and memory block 310 will be explained. As described above, each page management record 200 manages generation and its completion, deletion, and the like of page data 210 for each 25 encoding format. Fig. 6 exemplifies a case wherein RAW data and JBIG data are generated.

Each page data has Width, Length, Size, Memory_Block, and the like as its structure. Note that Width indicates the number of main scan dots of the scanned image, and Length indicates the number of 5 sub-scan dots of that image. Based on these two parameters, the size of the image (X dots × Y dots) can be determined.

Size indicates the data size of the image data. Memory_Block indicates the address of the first memory 10 block 310 where actual data is stored.

In Fig. 6, raw data obtained by scanning image data by the scanner processor 410 is managed by generated RAW page data, and is stored in the memory block 310. Each memory block 310 is formed by, e.g., 15 segmenting the RAM 103 into a plurality of memory areas. Data that cannot be stored in one memory block 310 is also stored in another memory block 310, and these memory blocks are associated by pointers. A Next pointer indicates the next memory block where data is 20 stored, and a Prev pointer indicates the immediately preceding block where data is stored. In this manner, by segmenting the data storage areas, the memory can be efficiently used. Note that Fig. 6 exemplifies a case wherein actual data is stored in the area of the memory 25 block 310. Alternatively, data may be managed by still another memory area, and the memory block 310 may manage only its address pointer.

<Page Data Control Operation>

Figs. 8 to 13 are flowcharts and the like showing the page data control operation when a monochrome copy process is executed as an example of the image process.

- 5 Note that the operations of these flowcharts are controlled by the CPU 101.

The page data control method of an image scanner unit upon executing the monochrome copy process will be described below using Fig. 8.

- 10 If it is determined in step S501 that a scan start request is issued by the scanner 104 (= 410 in Fig. 7), the flow advances to step S502.

In step S502, a page management record 200 is acquired. Fig. 9 shows an overview of this acquisition 15 operation. When the scanner processor 410 begins to scan images, and prepares for scanning the image of the first page (620), a request that instructs to generate a page management record is issued to the memory manager 610. The memory manager 610 is implemented by 20 a software program stored in the ROM 102, and manages the number of current page management records, page management records in use, and the like. Upon reception of the request, the memory manager 610 creates a page management record 200 on a page 25 management record area of a memory map 630. A page management record area 640 is managed for respective page management records (#1, #2, #3,...), and if use of

a given page management record ends, that record is released (deleted) from the page management record area 640, and its free area is used for another page management record. In this way, the page management 5 record for the image of the first page is acquired.

Referring back to the flowchart of Fig. 8, Raw page data is acquired in step S503. After the page management record is acquired, a Raw page data generation request is issued from the scanner processor 10 410 to the memory manager 610, and Raw page data corresponding to the image data of the first page is generated on a page data area of the memory map 630 in the same manner as in generation of the page management record.

15 Image data (first page) scanned in step S504 is stored as raw data in a memory block associated with the Raw page data in step S505. At this time, the page management record and Raw page data are acquired, as indicated by 810 and 820 in Fig. 11.

20 Upon completion of the scan process for one page, a page FIX message is output in step S506. At this time, in Status (Fig. 6) described above, status has changed from "RUN" to "FIX" for Raw data. With this status, other processors (printer processor, FAX 25 processor, and the like) can use this Raw data.

In step S507, JBIG page data is acquired. An overview of this process is indicated by 830 in

Fig. 11. In step S508, the Raw page data stored in step S505 is encoded by JBIG. In step S509, JBIG data obtained by encoding the Raw data by JBIG is stored in the JBIG page data acquired in step S507 (840,

5 Fig. 11). At this time, if the Raw page data whose JBIG encoding is complete is not referred to by other processors, that Raw page data can be released (850).

If it is determined in step S510 that the next page is present, the flow returns to step S502, and the 10 processes for the next and subsequent pages similarly continue. If it is determined in step S510 that no next page is present, the flow returns to step S501 to wait for another scan start request. In this way, if a plurality of pages of images are scanned, the memory 15 manager 610 generates page management records in correspondence with the number of pages, and are associated with each other, as shown in Fig. 4.

Fig. 10 is a flowchart for explaining the page data control operation of the printer (= 420 in 20 Fig. 7) 105 when the monochrome copy process is done as an example.

If it is determined in step S701 that a print process instruction is issued and a printable page is available, the flow advances to step S702.

25 It is checked in step S702 if "FIX" JBIG page data is available. That is, in case of a normal print operation, since the print operation is executed by

decoding JBIG data into Raw data, it is checked first if JBIG data is available.

If it is determined in step S702 that no "FIX" JBIG page data is available, Raw data managed by Raw page data is printed out in step S703, and the flow returns to step S701. This phenomenon occurs when the print process of the first page is done. Even when the image of the first page is not encoded by JBIG, since the print process can be executed using Raw data, impression that the high-speed print process is executed can be given to the user. Note that the Raw page data which has been printed out to the printer can be released when it is not referred to by other processors. Fig. 12 shows this state. That is, Raw data managed by Raw page data undergoes a print process, and is sequentially encoded by JBIG. At this time, if JBIG data are stored in memory blocks managed by JBIG data and are not referred to other processors (e.g., the FAX processor and the like), Raw page data is released (deleted from the corresponding page management record), as indicated by 920.

If it is determined in step S702 that "FIX" JBIG page data is available, Raw page data 1010 is acquired, as shown in Fig. 13, in step S704. Since this acquisition operation has already been explained, a description thereof will be omitted.

In step S705, JBIG data managed by the JBIG page data is decoded to generate Raw data.

Next, in step S706 the decoded Raw data is stored in a memory block associated with the Raw page data 5 acquired in step S704.

In step S703, the Raw data stored in the Raw page data is printed out. If the Raw page data corresponding to the Raw data which has been printed out to the printer is not referred to by other 10 processors, that Raw page data can be released (deleted from the corresponding page management record).

The aforementioned operation is repeated until the printout processes for all pages are completed.

<Effect Of Embodiment>

15 As described above, according to this embodiment, since one page management record has a plurality of page data which are stored in different encoding formats, the output side that requires conversion of an encoding format need not independently have page 20 management records for rendering and page data, the memory diversity can be accommodated, and the memory use size can be reduced. If already "FIX" page data is available, since the processor that uses page data can use that page data even when encoding/decoding is in 25 progress, high-speed processing can be attained.

That is, according to this embodiment, encoding processes corresponding to respective image processing

functions can be efficiently implemented while minimizing the memory use size in the apparatus.

<Other Embodiments>

Note that the present invention can be applied to
5 an apparatus comprising a single device or to system
constituted by a plurality of devices.

Furthermore, the invention can be implemented by supplying a software program, which implements the functions of the foregoing embodiments, directly or
10 indirectly to a system or apparatus, reading the supplied program code with a computer of the system or apparatus, and then executing the program code. In this case, so long as the system or apparatus has the functions of the program, the mode of implementation
15 need not rely upon a program.

Accordingly, since the functions of the present invention are implemented by computer, the program code installed in the computer also implements the present invention. In other words, the claims of the present
20 invention also cover a computer program for the purpose of implementing the functions of the present invention.

In this case, so long as the system or apparatus has the functions of the program, the program may be executed in any form, such as an object code, a program
25 executed by an interpreter, or script data supplied to an operating system.

Example of storage media that can be used for

supplying the program are a floppy disk, a hard disk, an optical disk, a magneto-optical disk, a CD-ROM, a CD-R, a CD-RW, a magnetic tape, a non-volatile type memory card, a ROM, and a DVD (DVD-ROM and a DVD-R).

5 As for the method of supplying the program, a client computer can be connected to a website on the Internet using a browser of the client computer, and the computer program of the present invention or an automatically-installable compressed file of the
10 program can be downloaded to a recording medium such as a hard disk. Further, the program of the present invention can be supplied by dividing the program code constituting the program into a plurality of files and downloading the files from different websites. In
15 other words, a WWW (World Wide Web) server that downloads, to multiple users, the program files that implement the functions of the present invention by computer is also covered by the claims of the present invention.

20 It is also possible to encrypt and store the program of the present invention on a storage medium such as a CD-ROM, distribute the storage medium to users, allow users who meet certain requirements to download decryption key information from a website via
25 the Internet, and allow these users to decrypt the encrypted program by using the key information, whereby the program is installed in the user computer.

Besides the cases where the aforementioned functions according to the embodiments are implemented by executing the read program by computer, an operating system or the like running on the computer may perform 5 all or a part of the actual processing so that the functions of the foregoing embodiments can be implemented by this processing.

Furthermore, after the program read from the storage medium is written to a function expansion board 10 inserted into the computer or to a memory provided in a function expansion unit connected to the computer, a CPU or the like mounted on the function expansion board or function expansion unit performs all or a part of the actual processing so that the functions of the 15 foregoing embodiments can be implemented by this processing.

As many apparently widely different embodiments of the present invention can be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the 20 appended claims.

CLAIM OF PRIORITY

25 This application claims priority from Japanese Patent Application No. 2004-090059 filed on March 25, 2004, the entire contents of which are hereby

incorporated by reference herein.